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SOCIOECONOMIC DIFFERENTIALS IN CHILD STUNTING ARE CONSISTENTLY LARGER IN URBAN THAN IN RURAL AREAS

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ABSTRACT

Urban-rural comparisons of childhood undernutrition suggest that urban populations are better-off than rural populations. However, these comparisons could mask the large differentials that exist among socioeconomic groups in urban areas. Data from the Demographic and Health Surveys (DHS) for 11 countries from three regions were used to test the hypothesis that intra-urban differentials in child stunting were greater than intra-rural differentials, and that the prevalence of stunting among the urban and the rural poor was equally high. A socioeconomic status (SES) index based on household assets, housing quality, and availability of services was created separately for rural and urban areas of each country, using principal components analysis. Odds ratios (OR) were computed to estimate the magnitude of differentials in stunting (height-for-age Z-scores < –2) between urban and rural areas and between the lowest and highest SES quintiles within areas. The prevalence of stunting was lower in urban than in rural areas for all countries, but rural-urban ORs were relatively small (< 3.3). As hypothesized, the gap between low and high SES was markedly larger in urban (median OR = 4) than rural (median OR = 1.8) areas, and differences were statistically significant (interaction between area and SES in logistic regression) in all but three countries. Within-urban ORs as high as 10 were found in Peru and the Dominican Republic, whereas within-rural ORs were smaller than 3.5, except in Brazil. In most countries, stunting in the poorest urban quintile was almost on par with that of poor rural dwellers. Thus, malnutrition in urban areas continues to be of concern, and effective targeting of nutrition programs to the poorest segments of the urban population will be critical to their success and cost-effectiveness.

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ACKNOWLEDGMENTS

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1. INTRODUCTION

Population growth estimates suggest that urban populations are growing about three times faster than rural populations. By the year 2025, it is estimated that over 80 percent of the developing world will be living in urban areas. Such increases in urban populations in developing countries are accompanied by increasing urban poverty and malnutrition. Recently compiled data show that both the absolute numbers of urban poor and the contribution of urban poverty to overall poverty levels have been increasing over the past two decades (Haddad, Ruel, and Garrett 1999). Similar trends are also observed for urban childhood undernutrition. The magnitude of this problem, however, is not well documented, and data are generally lacking to convince policymakers of the urgency of turning their attention to escalating rates of urbanization and the potential consequences this may have for urban poverty and malnutrition. Most program and policy decisions about resource allocation continue to rely on simple urban-rural comparisons. The danger of using such comparisons is that they mask the enormous differentials that exist among socioeconomic groups in urban areas.

The present paper argues that although socioeconomic differentials in malnutrition do exist both in urban and in rural areas, they are of significantly larger magnitude in urban areas. Data from the Demographic and Health Surveys (DHS) for 11 countries (two in Asia, five in Latin America, and four in Africa) were used to test this hypothesis as well as the hypotheses that intra-urban differentials are larger than overall urban-rural differences and that the prevalence of stunting among the urban poor is often as high as among the rural poor.

Other researchers have noted that using global statistics to characterize poverty and childhood malnutrition in urban areas may be misleading, because city averages do not capture the large heterogeneity found between social classes in urban areas (Basta 1977). The magnitude of differentials in childhood malnutrition, morbidity, and mortality between socioeconomic groups in urban areas has also been documented (Basta 1977; Bradley et al. 1992; Maxwell et al. 2000; Timaeus and Lush 1995; Bicego and Ahmad 1996. To our knowledge, however, this is the first study that systematically addresses this question by directly comparing the magnitude of such differentials in the prevalence of childhood stunting between urban and rural areas.

2. DATA AND METHODS

Data from the DHS (rounds II and III) were used to examine the study hypotheses. The DHS program is funded by the United States Agency for International Development (USAID) through a contract with Macro International, Inc., and data collection is usually carried out in collaboration with country governments. Population sampling frames are used for the data collection, which makes the data sets nationally representative. These data sets are in the public domain and are available from the DHS website (www.macroint.com/dhs). We used the most recent data sets, available as of June 1997, from Bangladesh and Pakistan for Asia; Tanzania, Ghana, Senegal, and Zambia for

Africa; and Brazil, Colombia, Dominican Republic, Peru, and Guatemala for Latin America. The two main criteria for selection were that (1) the data set contains information on child anthropometry, and (2) both the urban and the rural samples include at least 500 children 0–36 months of age. This second criterion was important to allow an adequate sample size for the planned disaggregated analysis by quintile of socioeconomic status. Stunting was defined as height-for-age Z-score less than –2 standard deviations of the WHO/NCHS/CDC reference standards (WHO 1979).

CREATION OF A SOCIOECONOMIC INDEX

The first step in the analysis was to create a socioeconomic index for each country and each area (urban and rural), using the type of data available at the household level in the DHS data sets. A valid index of socioeconomic status (SES) should be expected to contain variables from different domains, because socioeconomic status is a multidimensional concept (Carmines and Zeller 1979). In the DHS data sets, data are available on three main domains of household wealth: (1) characteristics of the dwelling (floor, walls, and roofing material); (2) availability of water and sanitation services; and (3) ownership of household durable goods such as a bicycle, television, or radio. Other domains that one might expect to include in a scale of socioeconomic status are household income and parental education. The DHS data sets do not contain information on household income, and we deliberately avoided including education in this scale, because education has some effects on child health and nutrition that are known to be independent of the effects of socioeconomic status (Behrman and Wolfe 1987; Ruel et al.

1999). For this index to be content valid, therefore, one would expect that at least some variables from all three domains would be included in the final index.

The main purpose of creating the index was to categorize households into socioeconomic status (SES) quintiles, and to compare the difference in the prevalence of stunting between the lowest and highest socioeconomic groups. The index was constructed separately for each country and for urban and rural area within each country, because the characteristics that define wealth were expected to be different from one country to the other, as well as between the urban and rural areas of a country.

Principal components analysis was used to derive one factor from the selected wealth variables (see Table 1 for list of variables). All variables were categorical and ranked by ascending order (from worst to best). The selection criteria for inclusion of individual variables into the final factor was that factor loadings (defined as the correlation between the variable and the factor) had a value greater than 0.4.[1] To assess the comparability of the SES indices between urban and rural areas, we conducted paired t-tests to examine whether factor loadings were significantly different between urban and rural areas of the same country. For each country and area, the newly created variable reflecting the factor scores was then ranked into quintiles to create five SES status groups. All further statistical comparisons in stunting prevalence were made between the lowest and the highest SES groups.

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[1]Only in the case of Ghana was a variable with a factor loading as low as 0.28 maintained, because no other variables besides drinking water and nondrinking water source loaded strongly with the factor.

ANALYSIS OF DIFFERENTIALS

We used odds ratios (OR) to quantify the magnitude of differentials in stunting prevalence. The overall urban-rural and the lowest SES versus highest SES ORs were computed using the following formula:

$$p/(1-p) \div q/(1-q),$$

where p = proportion of stunted children in rural areas, and q = proportion of stunted children in urban areas.

ORs were used rather than prevalence rate ratios since the latter are limited by the fact that there are ceilings on their values in situations where the prevalence of the outcome of interest is large, even in the lowest risk group. ORs are not constrained by this statistical artifact and can take any value up to infinity (Davies, Crombie, and Tavakoli 1998).

ORs for differences between socioeconomic groups within a given area were computed to determine the magnitude of differences in stunting prevalence between the highest and the lowest SES groups within urban and within rural areas, respectively. These were calculated using the following logistic regression model:

$$\text{Stunting} = \beta_0 + \beta_1(\text{area}) + \beta_2(\text{SES}) + \beta_3(\text{area*SES}),$$

where the variables are defined as follows:

Stunting	1 = stunted; 0 = not stunted,
Area	1 = urban; 0 = rural,
SES	1 = low SES; 0 = high SES.

A statistically significant coefficient ($p<0.2$) for the interaction term between area and SES indicated that the magnitude of the socioeconomic differentials observed was different between urban and rural areas, i.e., that the within-urban and the within-rural ORs were statistically significantly different.

Analyses were done using EPI-Info 6.0 (for unadjusted ORs) and SPSS 8.0 (for logistic regression and factor analysis) (SPSS 1998; Dean et al. 1996).

3. RESULTS

The results of the factor analysis indicate clearly that in all countries, our SES scale was a good reflection of its underlying variables (Table 1). The factors were generally strong in that most explained more than 50 percent of the variance of the variables retained in the factor (ranging from 35.3 percent for urban Brazil to 64.1 percent for rural Ghana; see Table 1). The factors also included variables from the three dimensions of socioeconomic status hypothesized (water and sanitation, housing quality, and assets) in 18 out of 22 of the models. There was also no systematic difference in the number of variables entering the index in rural and urban areas, nor was there any systematic difference in the proportion of the total variance in these variables explained by the model. Within countries, factor loadings appeared to be broadly comparable in urban and rural areas (paired t-tests; not shown), although there was a clear and statistically significant tendency for the variable TOILET to load more heavily in urban compared to rural areas.

Figure 1 shows that the prevalence of stunting was consistently higher in rural areas compared to urban areas for all countries and regions. Figures 2 and 3 also show that, irrespective of area of residence, the prevalence of stunting among children from lower socioeconomic groups was consistently greater than among children from higher socioeconomic groups. Table 2 summarizes these results by presenting the ORs (and their 95 percent confidence intervals) for these different comparisons. First, all ORs of urban-rural differences were statistically significant, and ranged from 1.3 for Tanzania to 3.3 for Peru. Thus, for the countries studied, the odds of a child being stunted if he or she lived in a rural area were between 1.3 and 3.3 times greater than for a child living in an urban area.

When looking at differences by socioeconomic group within rural and urban areas, respectively, again all ORs were statistically significant, except for the within-rural differences in Ghana and Senegal. The magnitude of the ORs for socioeconomic differences in rural areas ranged from 1.4 in Senegal to 7.5 in Brazil, with a median of 1.8. There was some tendency, although not entirely consistent, for higher within-rural ORs in Latin America than in Africa and Asia (the four highest ORs were in Latin American countries). In urban areas, the median OR for socioeconomic differentials was more than twice as large as the median OR in rural areas (4 versus 1.8) and the values ranged from 2.4 in urban Zambia to 10.2 in urban areas of the Dominican Republic. Again, the magnitude of the ORs in urban areas tended to be larger in Latin America than in Africa and Asia, but the pattern was not totally consistent. For each country except Brazil, the within-urban ORs were larger than the within-rural ORs. Estimates of the coefficients of the interaction term between area and SES revealed that for all but three countries, the within-urban ORs were statistically significantly greater than the within-rural ORs ($p < 0.10$ in all cases). The countries for which differences were not statistically significant were Brazil, Ghana, and Zambia ($p > 0.2$; Table 2). Note also that at the national level, the within-urban ORs were systematically greater than the overall urban-rural ORs.

Figure 4 provides a graphical illustration of the results described above. Each box represents one country. The vertical line on the left side of the box shows the difference in the prevalence of stunting in low and high SES groups in rural areas, while the right side of the box shows the difference between the low and high SES groups in the urban areas. The horizontal top line of the box shows the difference between the rural poor and the urban poor, and the bottom line, the difference between the rural and the urban high SES groups. Under an ideal situation, the box would be slim, with no distortion, indicating no difference in the prevalence of stunting between urban and rural areas, or between socioeconomic groups. Figure 4, however, indicates that this is far from being the case. It shows that most countries follow a clear trapezoid shape, thus highlighting the marked differentials in stunting between SES groups, especially in urban areas. The figure also demonstrates that in most countries, the gap between the rural and the urban poor is small (top horizontal line), in spite of the fact that the prevalence of stunting is always somewhat higher among the rural poor.

Figure 4 and all previous analyses focused on the extreme quintiles of the socioeconomic index scale. Figures 5 and 6 are presented, however, to highlight the fact that differences in the prevalence of stunting in the countries studied generally followed a dose-response type of relationship.[2] This was true for both urban and rural areas, although differences by socioeconomic group were clearly more pronounced in urban areas.

4. DISCUSSION

Our analysis clearly shows that across the developing world there are large socioeconomic differentials in stunting among children 0–36 months old, these differentials are commonly greater in urban than in rural areas, and most disadvantaged urban children have rates of stunting that are, on average, only slightly lower than the most disadvantaged rural children. These conclusions are drawn from large, nationally representative data sets from 11 countries in three continents. Data collection procedures were similar in all cases, and an identical analytic methodology was applied.

Many previous studies have addressed socioeconomic differentials in child nutritional status in either rural (Arroyave, Guzman, and Flores 1976; Bhuiya, Zimicki, and d’Souza 1986; Lindtjorn, Alemu, and Bjorvatn 1993) or urban (Timaeus and Lush 1995; Monteiro, de Freitaas, and Baratho 1989) areas. Rarely, however, has the magnitude of socioeconomic differentials been contrasted for comparable sets of urban and rural children. Ricci and Becker (1996) found that in Metro Cebu, in the Philippines, household socioeconomic characteristics were important determinants of stunting in

[2] The figures present only a subset of countries for illustrative purposes.

children aged 12–29 months in both rural and urban areas, and that the effect of these factors on the risk of stunting was detectable earlier in rural than in urban *barangays*. However, because the regression models for the two strata used a different set of socioeconomic indicators, it is difficult to compare the importance of socioeconomic status across the two strata. In Mozambique, Garrett and Ruel (1999) found that household expenditures, parental education, and crowding were similarly associated with the children's height-for-age Z-scores in both rural and urban areas. Using well water, however, was strongly associated with lower height-for-age Z-scores only in urban areas. In both studies, the variables used as proxies for socioeconomic status were not equally common in rural and urban areas, making it difficult to judge whether the *relative* differentials between the more and less disadvantaged were of similar magnitude in rural and urban areas.

In the present study, this difficulty was overcome by using compound indices of socioeconomic status that—for both the rural and urban strata—were able to divide the population into five equally-sized groups, thereby ensuring that in each case the upper quintile of socioeconomic status was compared to the lower quintile. This approach aimed only to rank these households relative to other households *in the same residential stratum.* There was no intention to infer that households in the lower SES quintile in urban areas of a given country experienced similar economic conditions to households in the lower quintile in rural areas of the same country.

Krieger, Williams, and Moss (1997) have suggested that ideally, valid measures of socioeconomic position should include variables that reflect both household resources such as assets, income, or education, and prestige- or rank-based characteristics such as social class. While our SES index does not contain measures of social rank, we believe that the area-specific indices created for each country in this study are valid indicators of the socioeconomic position of these households within area and country, particularly for the purpose that they were designed to serve. Also, we believe that variables that reflect household resources are more likely to be associated with health and nutrition outcomes than variables that reflect social rank. The content validity of our indices (Carmines and Zeller 1979) is clearly demonstrated by the fact that in virtually all countries, the three domains that we had set out to include in an SES index were, in fact, included in the final factor that made up the index. These include (1) ownership of durable goods, (2) construction of the dwelling, and (3) access to water and sanitation. As mentioned earlier, the domain of parental education was purposefully left out, and data on income are not available in the DHS surveys.

Our study showed that children living in urban areas might be up to 10 times more at risk of being stunted if they are from poor households compared to children from households of higher socioeconomic status. The fact that there are consistently such strong socioeconomic gradients in urban areas of developing countries implies that reliance on global average statistics to allocate resources between rural and urban areas could be dangerously misleading, a point originally made by Basta (1977). We have previously shown that the "average" urban child is consistently less likely to suffer from stunting than the "average" rural child (Ruel et al. 1998), yet in virtually every case studied in the present analysis, there was a distinct group of highly vulnerable urban children that should be high on the list of national priorities for nutrition-oriented interventions. We were unable to determine from these data whether intracity or intercity differences are likely to account for most of the overall within-urban sector differences observed. Previous research, however, suggests that even within neighborhoods of the same city, there is a great deal of variation in attained nutritional status (Morris et al. 1999). Targeting the nutritionally vulnerable in urban areas, therefore, may require imaginative and far-reaching programs to respond to the growing numbers of urban poor and undernourished.

5. POLICY IMPLICATIONS

Our research is part of an increasing body of research on the conditions in which poor urban dwellers live and of the deleterious effects of these conditions on health (Ruel, Haddad, and Garrett 1999). This piece of research demonstrates the dire need for program and policy attention to ameliorate the nutrition situation of the population living in poor urban areas. Health and nutrition interventions, in conjunction with poverty reduction measures, are priorities for the urban poor as much as they are for the rural poor. We believe that with evidence such as this, developing countries cannot afford to ignore the situation in which poor urban populations live.

TABLES

Table 1—Results of principal components analysis to create a household socioeconomic index (factor loadings and variance explained by the factor), by country and by urban/rural area

Country	Year	DHS Round	Variables used in SES scale (factor loadings)							Variance explained by component (%)
			Drinking water	Non-drinking water	Toilet	Floor material	Wall material	Roofing material	Durable goods	
Bangladesh, rural	1993	3	--	--	0.72	0.67	0.71	0.59	0.73	47.4
Bangladesh, urban	1993	3	0.71	0.78	0.74	0.84	0.78	0.75	0.72	57.9
Pakistan, rural	1991	2	0.93	0.93	0.48	--	--	--	0.52	56.1
Pakistan, urban	1991	2	0.80	0.83	0.68	--	0.62	0.69	0.67	51.7
Ghana, rural	1993	3	0.96	0.96	--	0.28	--	--	--	64.1
Ghana, urban	1993	3	0.92	0.91	0.53	--	--	--	0.59	57.0
Senegal, rural	1992	2	0.83	0.80	0.51	0.61	--	--	0.64	47.1
Senegal, urban	1992	2	0.87	0.87	0.65	0.45	--	--	--	50.8
Tanzania, rural	1991	2	0.94	0.94	--	0.43	--	--	0.33	51.6
Tanzania, urban	1991	2	0.90	0.89	0.47	0.71	--	--	0.46	51.0
Zambia, rural	1992	2	0.86	0.87	0.53	0.68	--	--	0.53	50.5
Zambia, urban	1992	2	0.92	0.92	0.79	0.54	--	--	0.53	58.0
Brazil, rural	1996	3	--	--	0.63	0.77	0.76	0.70	0.72	51.8
Brazil, urban	1996	3	0.70	0.73	0.59	0.42	--	--	0.59	35.3
Colombia, rural	1995	3	0.84	0.84	0.68	0.61	--	--	0.62	52.3
Colombia, urban	1995	3	0.93	0.93	0.67	0.44	--	--	--	59.2
Dom. Rep., rural	1991	2	0.70	0.70	0.66	0.60	--	0.56	0.66	42.2
Dom. Rep., urban	1991	2	0.78	0.75	0.73	--	0.47	--	0.70	48.3
Guatemala, rural	1995	3	0.53	--	0.73	0.70	--	--	0.82	49.4
Guatemala, urban	1995	3	0.55	--	0.79	0.59	--	--	0.72	45.9
Peru, rural	1992	2	0.88	0.88	0.63	0.55	--	--	0.62	52.8
Peru, urban	1992	2	0.85	0.85	0.77	0.67	--	--	0.65	58.5

Table 2—Odds of being stunted in rural compared to urban areas, overall and by socioeconomic status within rural and within urban areas

Country	Sample size		Urban vs. Rural, overall		Rural low vs. high SES		Urban Low vs. high SES		P-value of the interaction term (area* SES)[a]
	Urban	Rural	OR	95% C.I.	OR	95% C.I.	OR	95% C.I.	
Bangladesh 93	447	4,328	1.9	*1.6 - 2.3*	1.8	*1.6 - 2.2*	5.0	*2.6 - 9.6*	0.056
Pakistan 91	1,382	2,653	1.8	*1.5 - 2.0*	1.5	*1.1 - 1.9*	3.8	*2.6 - 5.7*	0.000
Ghana 93	520	1,297	2.4	*1.8 - 3.1*	1.6	*0.6 - 3.8*	4.0	*1.5 - 10.6*	0.277
Senegal 92	1,423	2,380	2.5	*2.1 - 3.0*	1.4	*1.0 - 1.8*	3.0	*1.7 - 5.2*	0.015
Tanzania 91	1,227	4,720	1.3	*1.2 - 1.5*	1.4	*1.2 - 1.7*	2.9	*1.9 - 4.7*	0.032
Zambia 92	2,290	2,566	1.8	*1.6 - 2.0*	2.3	*1.8 - 3.0*	2.4	*1.7 - 3.4*	0.863
Brazil 96	2,903	912	2.9	*2.3 - 3.5*	7.5	*3.3 - 16.8*	4.8	*2.8 - 8.5*	0.426
Colombia 95	2,776	1,631	1.6	*1.4 – 2.0*	1.8	*1.2 - 2.9*	4.0	*2.3 - 6.9*	0.037
Dominican Republic 91	1,689	1,194	2.2	*1.8 - 2.7*	3.5	*2.2 - 5.5*	10.2	*4.6 - 22.3*	0.018
Guatemala 95	2,505	5,262	2.4	*2.2 - 2.6*	3.3	*2.7 - 4.0*	6.9	*5.2 - 9.3*	0.000
Peru 92	4,328	2,709	3.3	*3.0 - 3.8*	2.6	*2.0 - 3.3*	9.9	*6.8 - 14.5*	0.000

[a] All p-values reported refer to the statistical significance of the interaction term between area (urban/rural) and socioeconomic status (SES) in a logistic regression model that included both these factors as main variables and the interaction term between the two.

FIGURES

Figure 1—Prevalence of stunting, by urban-rural residence (DHS data)

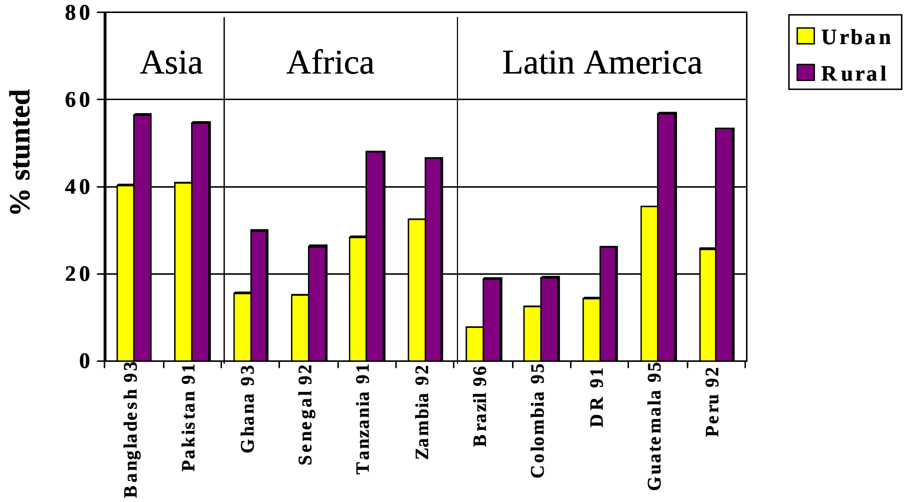


Figure 2—Prevalence of stunting in rural areas, by socioeconomic status (SES)

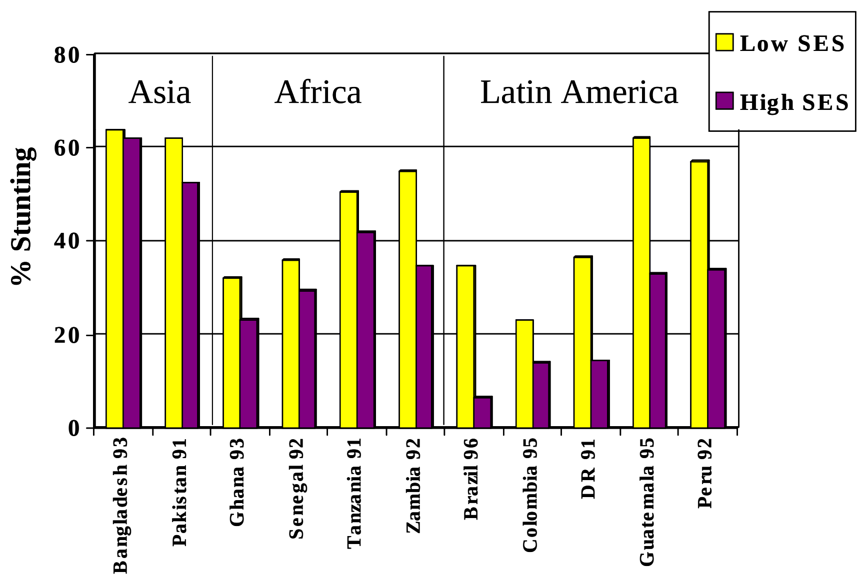


Figure 3—Prevalence of stunting in urban areas, by socioeconomic status (SES)

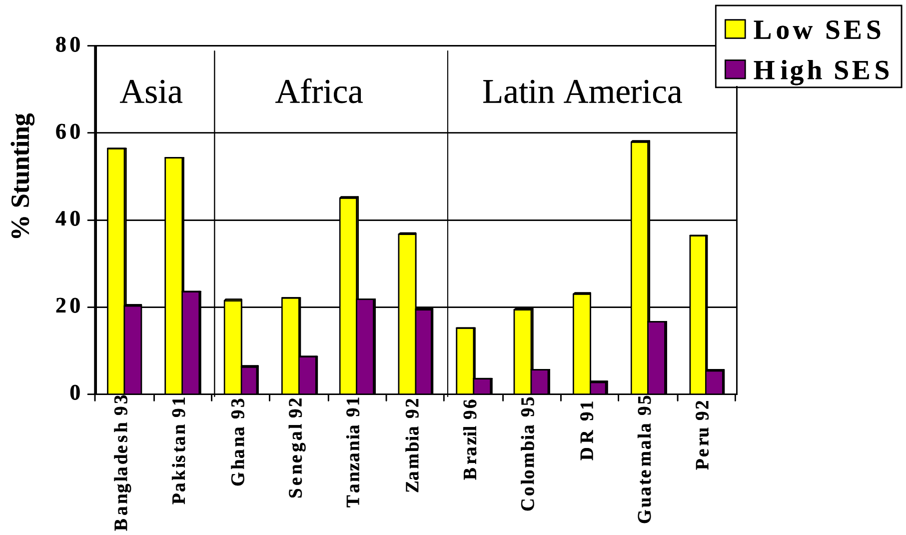


Figure 4—Summary of prevalences of stunting in urban and rural areas, by socioeconomic status (SES)

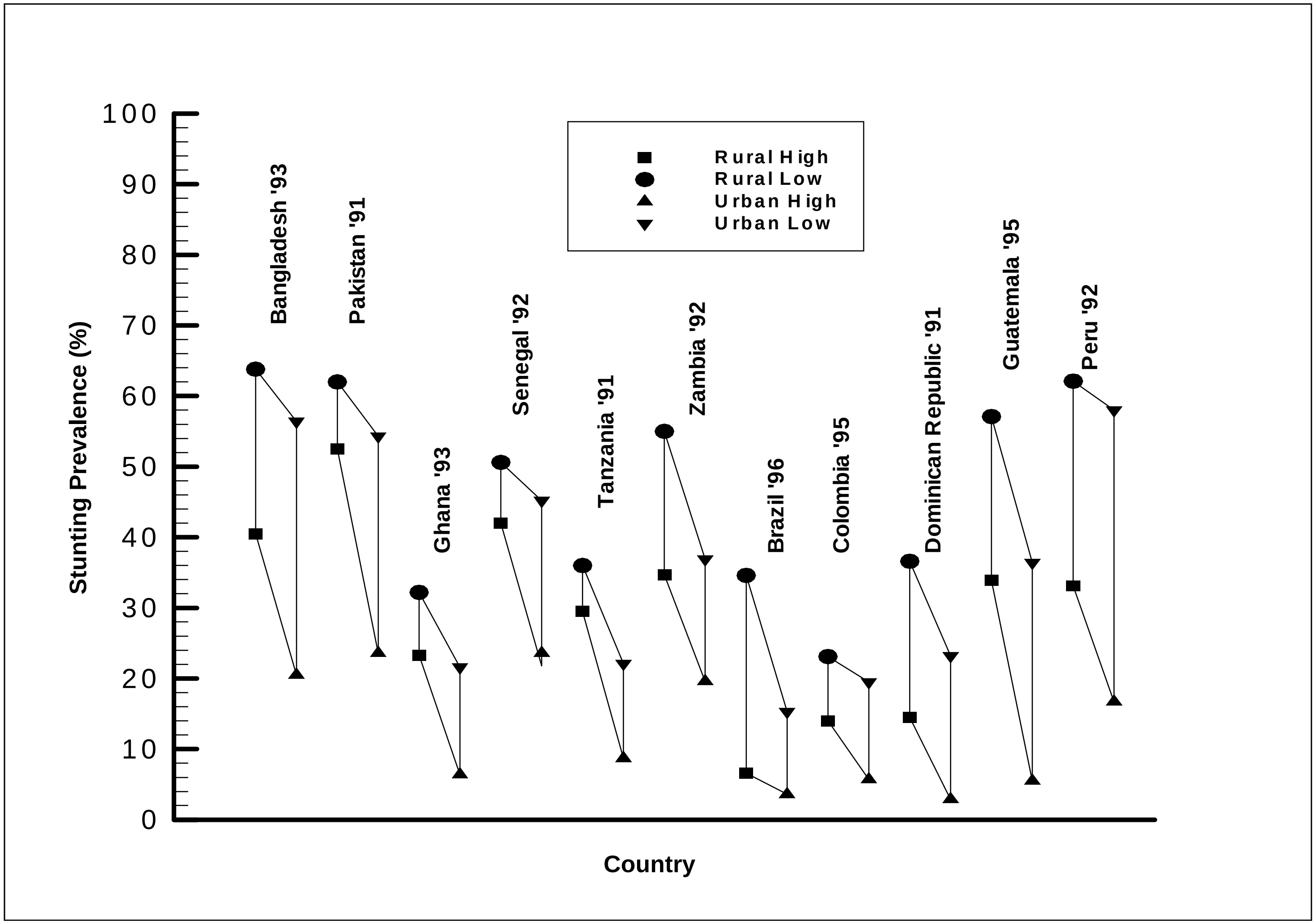


Figure 5—Prevalence of stunting in rural areas, by socioeconomic (SES) quintile, in a subset of countries

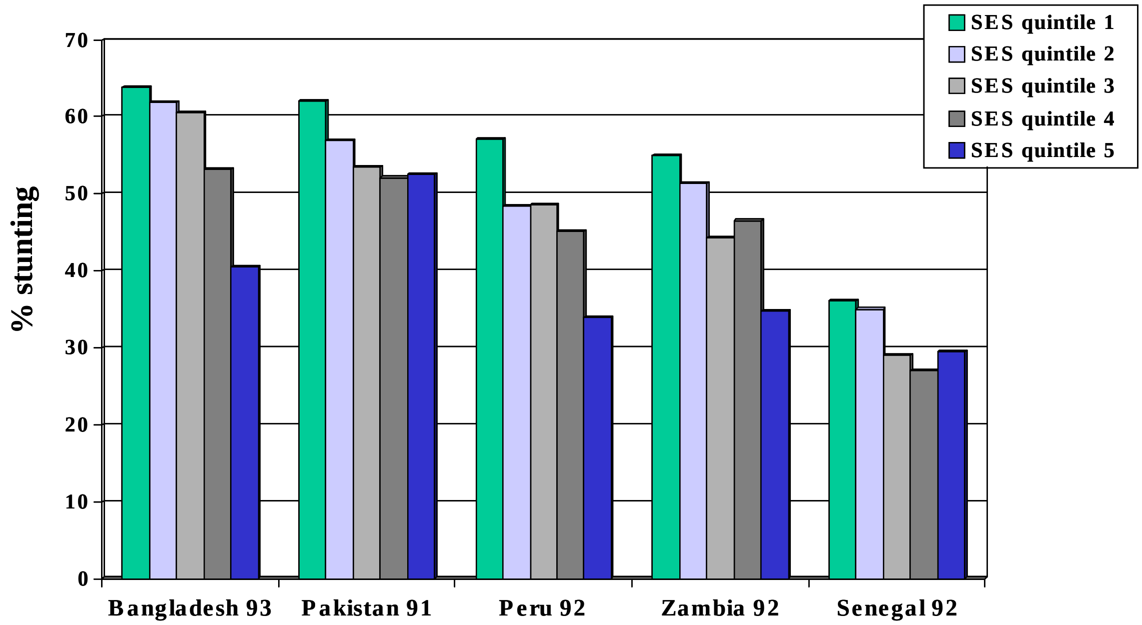
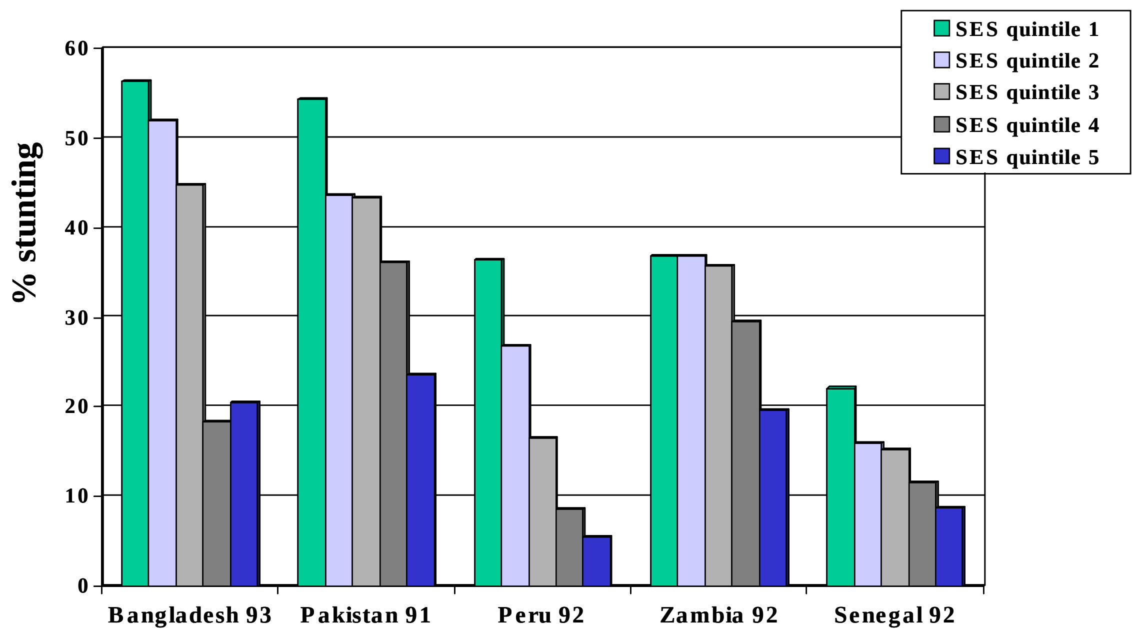


Figure 6—Prevalence of stunting in urban areas, by socioeconomic (SES) quintile, in a subset of countries



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